Siemens Energy & Automation	INSTALLATION AND SERVICE INSTRUCTION

SD63DL
Rev 9
December 2007
Supersedes Rev 8

Model Series 63DL Differential Type Flow Controller

INTRODUCTION

The 63DL Controller is used in conjunction with an external needle valve to provide constant volume flow rates for either liquids or gases over a continuously adjustable flow range.

In gas service, the 63D is used when the downstream pressure is constant to provide a constant mass flow rate (i.e. standard volume units per time unit; e.g. SCFM). In gas systems where the upstream pressure is constant, a 63U is used.

Constant downstream pressure is not needed for constant volume flow rates (i.e. volume units per time unit; e.g. CFM). Since liquids are incompressible, if the volume is held constant, then the mass is constant.

This instruction has eight major sections: Introduction, Installation, Principle of Operation, Capacity, Operation, Maintenance, Warranty, and Parts List.

Model Designation

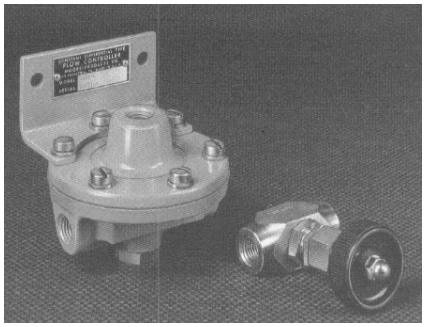
63 B D L

Constant Differential Flow Controller

Body Construction
- B – Brass (Neoprene Diaphragm)
- S – Stainless Steel (Kynar Diaphragm)

Used with Constant Downstream Pressure

Options
- L – Very Low Flow Rates
- 3A – With Rotameter Piped Assembly (Scale**:** 0.25 to 2.5 SCFH gas)
- 4A – With Rotameter Piped Assembly (Scale**:** 18-180 cc/min water)



Specifications

Supply Pressure

Minimum..... At least 5 psig greater than the maximum downstream pressure of the needle valve-controller combination

Maximum ..... See the table below

	Needle Valve	
Model	**Open**	**Closed**
63BD	250 psig	100 psig
63BD-L	250 psig	100 psig
63SD	500 psig	100 psig
63SD-L	500 psig	100 psig
63BD3A	150 psig	100 psig
63BD4A	150 psig	100 psig

Ambient Temperature Limits
Models 63BD & 63BD-L ..... -40° to +180°F (-40° to +82°C)
Models 63SD & 63SD-L..... -40° to +250°F (-40° to +120°C)

Controller Differential ..... 3.1 ±0.5 psig (others optional)

INSTALLATION

Shipping and Storage

If the controller is to be stocked, stored, or shipped to another location prior to piping, make sure that the factory installed plastic plugs are in the ports to prevent entry of moisture, dirt, or other contaminants.

Mounting

Mounting dimensions and the locations and sizes of connections are shown on the installation drawing; see Figure 1. The controller may be mounted in any position. Install the needle valve and feedback connections as close to the controller as possible to minimize pressure drop between these points. The supply to the controller must be filtered to remove any solids.

CAUTION

When installing the constant downstream controller, be sure the external needle valve is open; see Figure 1. Failure to do this could result in applying a differential pressure across the diaphragm of the flow controller in excess of its rate limit, thus causing the diaphragm to rupture.

Blow out all piping before connections are made to prevent the possibility of dirt or chips entering the controller. Use pipe sealant sparingly, and then only on the male threads. A non-hardening sealant is strongly recommended. Connect the controller to a source of clean, dry, oil-free instrument air. See Instrument Air Requirements.

CAUTION

Exceeding the specified ambient temperature limits can adversely affect performance and may cause damage to the controller.

CAUTION

Supply pressure in excess of that stated in the Specifications section may cause damage to the controller.

Instrument Air Requirements

Connect the instrument to a source of clean, dry, oil-free instrument air. Failure to do so will increase the possibility of a malfunction or a deviation from specified performance.

CAUTION

Use of process fluids other than instrument air is not recommended. No claim is made as to the suitability of this product for use with other process fluids, such as hazardous gases, except as listed on the appropriate certificate. Non-approved instruments are suitable for use with instrument air only. Optional features and modifications such as tapped exhaust do not imply suitability for use with hazardous gases except as listed on the approval certificate.

There are many types of synthetic compressor lubricants. Some may not be compatible with the materials used in construction of the instrument. Wetting of these materials by such an oil mist or vapor, etc., may cause them to deteriorate. This may ultimately result in failure of the positioner.

CAUTION

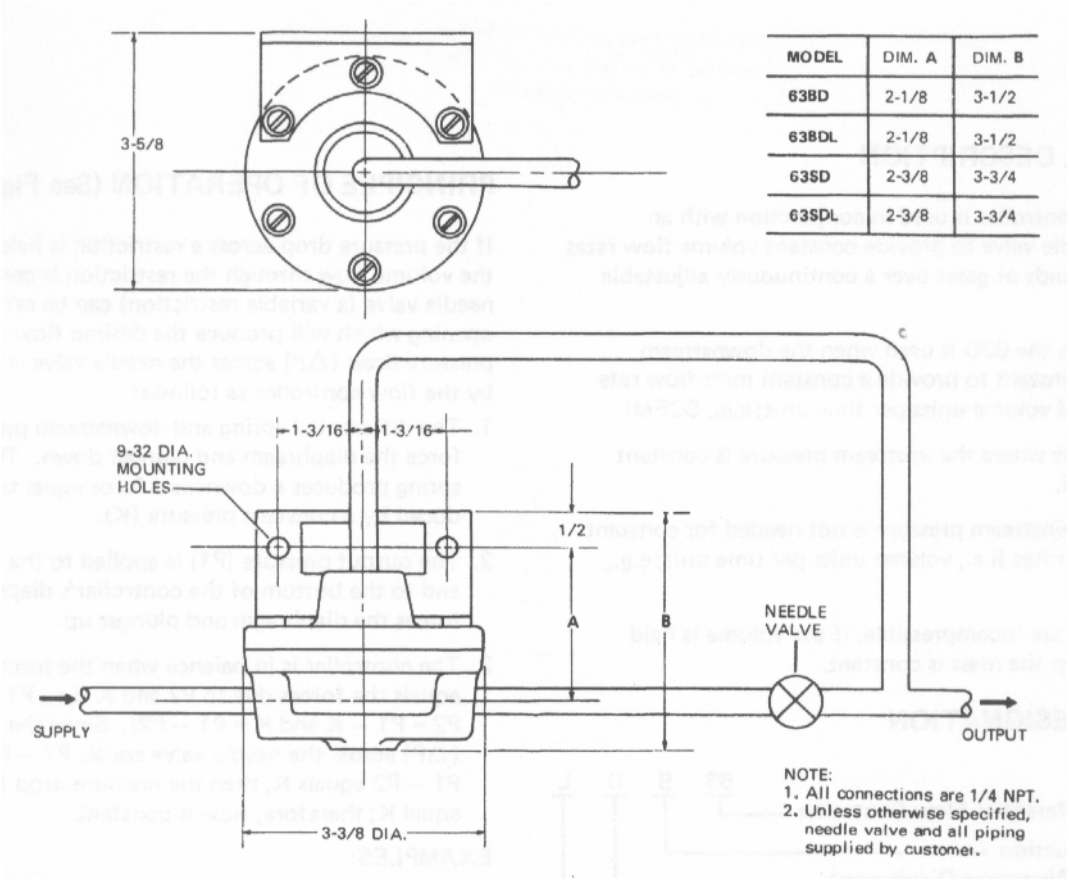
Synthetic compressor lubricants in the air stream at the instrument may cause it to fail.

The requirements for a quality instrument air supply can be found in the Instrument Society of America's "Quality Standard for Instrument Air" (ISA-S7.3). Basically, this standard calls for the following:

Particle Size — Maximum particle size in the air stream at the instrument should be no larger than 3 microns.

Dew Point — The dew point, at line pressure, should be at least 10°C (18°F) below the minimum temperature to which any part of the instrument air system is exposed at any season of the year. Under no circumstances should the dew point, at line pressure, exceed 2°C (35.6°F).

Oil Content — Maximum total oil or hydrocarbon content, exclusive of non-condensable, should not exceed 1 ppm under normal operating conditions.



MODEL	DIM. A	DIM. B
63BD	2-1/8	3-1/2
63BDL	2-1/8	3-1/2
63SD	2-3/8	3-3/4
63SDL	2-3/8	3-3/4

Figure 1 Installation Dimensions

PRINCIPLE OF OPERATION

If the pressure drop across a restriction is held constant, the volume flow through the restriction is constant; refer to Figure 2 on the next page. The needle valve (a variable restriction) can be set to an opening which will produce the desired flow rate. The pressure drop (ΔP) across the needle valve is held constant by the flow controller as follows:

1. The differential spring and downstream pressure (P2) force the diaphragm and plunger down. The differential spring produces a downforce equal to that produced by a constant pressure (K).
2. The output pressure (P1) is applied to the needle valve and to the bottom of the controller's diaphragm and forces the diaphragm and plunger up.
3. The controller is in balance when the force due to P1 equals the forces due to P2 and K (i.e. P1= P2+K; P2=P1-K; and K=P1-P2). Since the pressure drop (ΔP) across the needle valve equals P1-P2 and since P1-P2 equals K, then the pressure drop (ΔP) must equal K; therefore flow is constant.

Examples:

P1 = P2+K	**P2 = P1-K**	**K = P1-P2**
= 15+3	= 18-3	= 18-15
= 18 psig	= 15 psig	= 3 psig

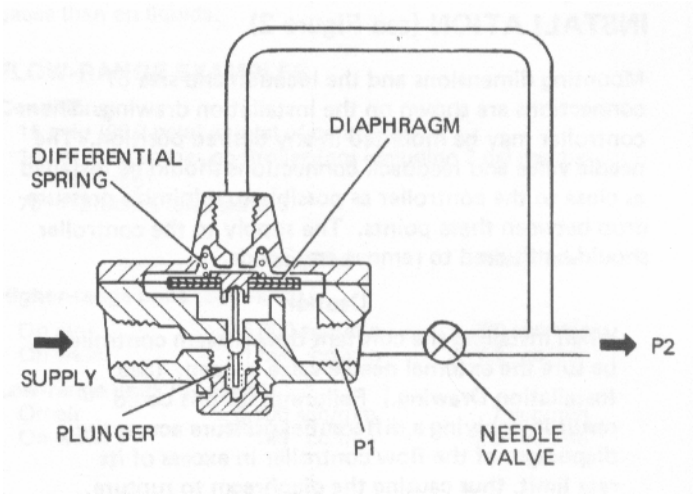


Figure 2 Schematic

CAPACITY

The formulas for the calculation of maximum and minimum flow rated can be found in Table 1.

The minimum controllable flow will depend on the leakage past the valve plunger in the controller. It is, therefore, a function of the cleanliness of the valve and pressure drop across it as well as any inherent leakage. In general, for a standard flow controller, the maximum controllable flow will be approximately 1/100 of the maximum flow.

OPERATION

With the supply turned on, adjust the needle valve to obtain the desired flow rate, within the capacity of the controller.

Table 1 Flow Capacity Formulas

	Higher Range Models 63BD and 63SD; 63BU and 63SU	Low Flow Models 63BD-L and 63SD-L; 63BU-L and 63SU-L
GAS FLOW-CAPACITY		
Maximum at less than critical flow *	$SCCM = 4000 \sqrt{\frac{\triangle P}{SG}} \times Pd \times \frac{530}{T}$	$SCCM = 400 \sqrt{\frac{\triangle P}{SG}} \times Pd \times \frac{530}{T}$
Maximum at critical flow *	$SCCM = 2000\ Pu \sqrt{\frac{1}{SG}} \times \frac{530}{T}$	$SCCM = 200\ Pu \sqrt{\frac{1}{SG}} \times \frac{530}{T}$
Minimum controllable flow	Approximately 1/200 of maximum	$SCCM = 8\ \frac{\triangle P\ (Pu + Pd)}{Rv\ T}$
LIQUID FLOW-CAPACITY		
Maximum	$CCM = 470 \sqrt{\frac{\triangle P}{SG}}$	$CCM = 47 \sqrt{\frac{\triangle P}{SG}}$
Minimum	Approximately 1/200 of maximum	$CCM = .06\ \frac{\triangle P}{Rv}$
NEEDLE VALVE SIZING (With 3 psi drop across valve)		
For any liquid	$Kn = \frac{CCM}{6550 \sqrt{\frac{1}{SG}}}$	
For any gas	$Kn = \frac{SCCM}{49000 \sqrt{\frac{1}{SG}} \times Pn \times \frac{530}{T}}$	

*Critical flow exists when the ratio of upstream pressure (Pu) to downstream pressure (Pd) is equal to or less than approximately 0.53:

$$\left(\frac{Pd}{Pu^*} \leq 0.53\right)$$

The actual ratio value for air is 0.528; it should be noted that it varies slightly for other gases.

SCCM = Cubic centimeters per minute of gas at standard conditions (70° F, 14.7 psia). Note: 1 SCF = 28,317 SCC.

ΔP = psi pressure drop across the controller valve = total drop minus 3 psi.

Pu = psia pressure at inlet of controller (allow 3 psi for drop across the needle valve, if it is installed upstream).

Pd = psia pressure at outlet of controller (allow 3 psi for drop across the needle valve, if it is installed downstream).

Pn = psia pressure at outlet of needle valve.

SG = Specific gravity of the gas referred to air, or specific gravity of the liquid referred to water at 4° C.

T = Absolute temperature of the gas = degrees F + 460.

Rv = Ratio of viscosities of gas referred to air; or Ratio of viscosities of liquid at operating temperature to water at 4° C.

Kn = Flow constant of needle valve.

Rangeability and minimum controllable flow of each size depend upon the needle valve used, the specific gravity of the fluid, the operating pressures, and other factors.

The formulas permit calculation of maximum flows for both the low-flow and higher-range models. Because minimum flows occur in a laminar pattern with the low-flow models, a separate formula is furnished. Rangeability is considerably higher on gases than on liquids.

FLOW-RANGE EXAMPLES

Conditions:
15 psig (29.7 psia) at inlet of controller
10 psi drop across controller (not including 3 psi needle-valve drop)
70° F process temperature

	Max. Flow	Min. Flow
Higher-range units (Series 63)		
On air	56,000 scc/min	280 scc/min
On water	1,500 cc/min	7.5 cc/min
Low-range units (Series 63L)		
On air	5,600 scc/min	7 scc/min
On water	149 cc/min	0.6 cc/min

MAINTENANCE

The only maintenance normally required is to keep the valve plunger and external needle valve clean. Any change in the rate of flow for a given needle valve setting will probably be caused by partial clogging of the needle valve.

CAUTION

Before disassembling the instrument, turn off supply air pressure to the instrument.

Failure to obtain minimum flows will probable be caused by solids on the controller valve plunger. In the Model Series 63D, this may be removed for cleaning by unscrewing the retaining nut in the base of the controller and removing the valve plunger and spring (see Figure 3).

A 63DL has a valve assembly which can be removed by first unscrewing the retaining nut in the base of the controller and then unscrewing the valve assembly. This assembly can be disassembled for cleaning by removing the snap ring fastened in the bottom of the valve port (see Figure 4).

IMPORTANT

The valve port and plunger are paired through a lapping process and must not be interchanged with other assemblies. Clean by washing in solvent. Do not use any abrasives.

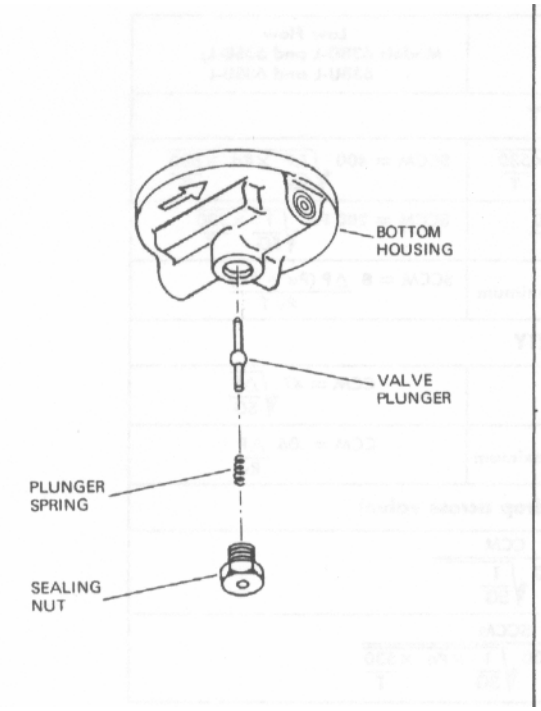


Figure 3 Valve Plunger, Model Series 63D

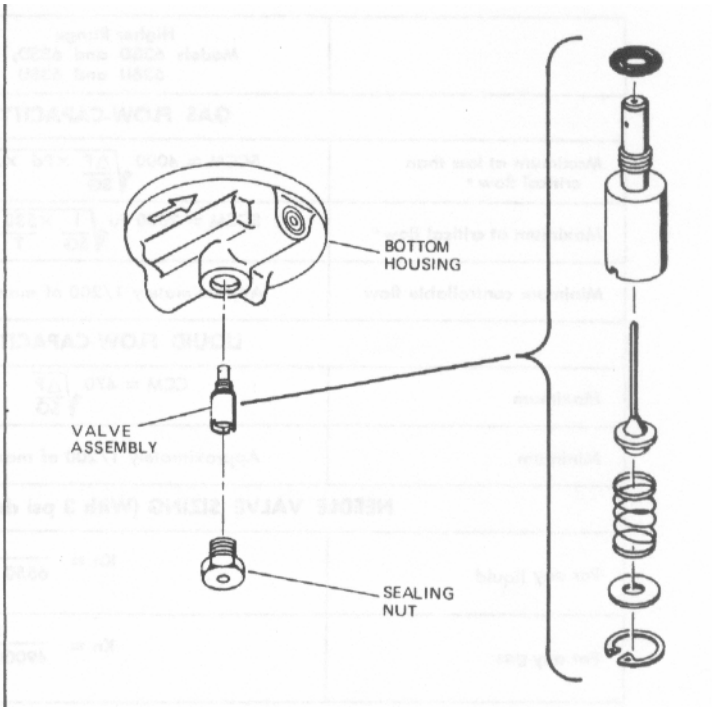


Figure 4 Valve Assembly, Model Series 63DL

Customer/Product Support

This section provides the Internet site addresses, e-mail addresses, telephone numbers, and related information for customers to access Siemens product support.

When contacting Siemens for support:

- Please have complete product information at hand:
  - For hardware, this information is provided on the product nameplate (part number or model number, serial number, and/or version).
  - For most software, this information is given in the Help > About screen.
- If there is a problem with product operation:
  - Is the problem intermittent or repeatable? What symptoms have been observed?
  - What steps, configuration changes, loop modifications, etc. were performed before the problem occurred?
  - What status messages, error messages, or LED indications are displayed?
  - What troubleshooting steps have been performed?
  - Is the installation environment (e.g. temperature, humidity) within the product's specified operating parameters? For software, does the PC meet or exceed the minimum requirements (e.g. processor, memory, operating system)?
- A copy of the product Service Instruction, User's Manual or other technical literature should be at hand. The Siemens public Internet site (see the table) has current revisions of technical literature, in Portable Document Format, for downloading.
- To send an instrument to Siemens for repair, request a Return Material Authorization (RMA).

IMPORTANT

An instrument must be thoroughly cleaned (decontaminated) to remove any process materials, hazardous materials, or blood born pathogens prior to return for repair. Read and complete the Siemens RMA form(s).

For customer/product support, visit the Siemens Process Instrumentation product support page at http://www2.sea.siemens.com/Products/Process-Instrumentation/Support/Customer-Support.htm. Select the desired type of support (e.g. application, product selection, sales, technical – see below).

Technical Support	
Telephone	1 800 333 7421
E-mail	techsupport.sea@siemens.com
Hours of Operation	8 a.m. to 4:45 p.m. eastern time, Monday through Friday (except holidays)
Technical Publications in PDF	http://www2.sea.siemens.com/Products/Process-Instrumentation/Support/PI-User-Manuals.htm then click the product line (e.g. Control Solutions)
Public Internet Site	http://www2.sea.siemens.com/Products/Process-Instrumentation
Repair Service	1 215 646 7400 extension 3187

WARRANTY

(a) Seller warrants that on the date of shipment the goods are of the kind and quality described herein and are free of non-conformities in workmanship and material. This warranty does not apply to goods delivered by Seller but manufactured by others.

(b) Buyer's exclusive remedy for a nonconformity in any item of the goods shall be the repair or the replacement (at Seller's option) of the item and any affected part of the goods. Seller's obligation to repair or replace shall be in effect for a period of one (1) year from initial operation of the goods but not more than eighteen (18) months from Seller's shipment of the goods, provided Buyer has sent written notice within that period of time to Seller that the goods do not conform to the above warranty. Repaired and replacement parts shall be warranted for the remainder of the original period of notification set forth above, but in no event less than 12 months from repair or replacement. At its expense, Buyer shall remove and ship to Seller any such nonconforming items and shall reinstall the repaired or replaced parts. Buyer shall grant Seller access to the goods at all reasonable times in order for Seller to determine any nonconformity in the goods. Seller shall have the right of disposal of items replaced by it. If Seller is unable or unwilling to repair or replace, or if repair or replacement does not remedy the nonconformity, Seller and Buyer shall negotiate an equitable adjustment in the contract price, which may include a full refund of the contract price for the nonconforming goods.

(c) SELLER HEREBY DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, EXCEPT THAT OF TITLE. SPECIFICALLY, IT DISCLAIMS THE IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, COURSE OF DEALING AND USAGE OF TRADE.

(d) Buyer and successors of Buyer are limited to the remedies specified in this article and shall have no others for a nonconformity in the goods. Buyer agrees that these remedies provide Buyer and its successors with a minimum adequate remedy and are their exclusive remedies, whether Buyer's or its successors' remedies are based on contract, warranty, tort (including negligence), strict liability, indemnity, or any other legal theory, and whether arising out of warranties, representations, instructions, installations, or non-conformities from any cause.

(e) Note: The above does not apply to any software which may be furnished by Seller. In such cases, the attached Software License Addendum applies.

Refer to the Customer/Product Support section of this manual for warranty and non-warranty service.

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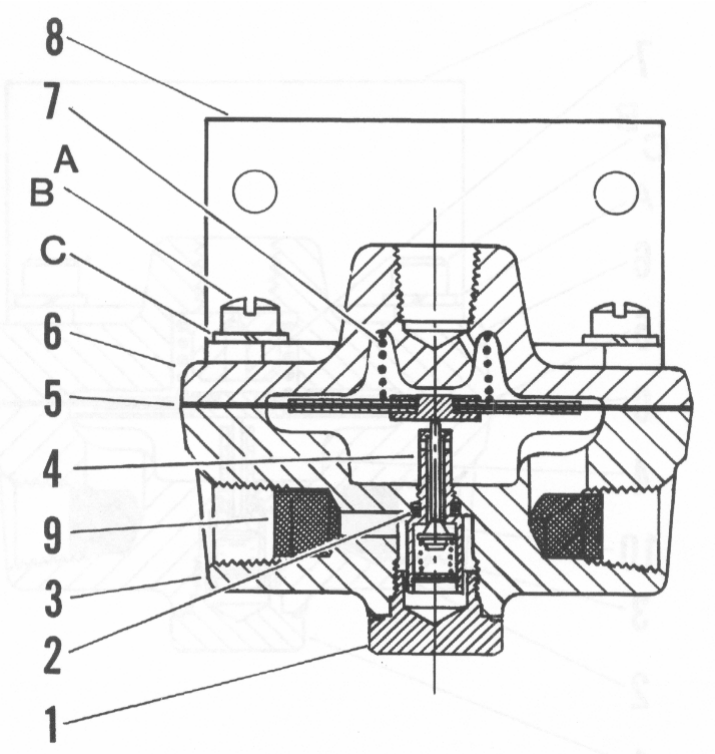
Procedures in this document have been reviewed for compliance with applicable approval agency requirements and are considered sound practice. Neither Siemens Energy & Automation, Inc. nor these agencies are responsible for repairs made by the user.

PARTS LIST

Siemens Flow Controller, Model 63BD-L

Drawing 10671PL

Rev 5/87



B/M - 10671S8

Item No.	Part No.	Description	Req'd.
* 1	10671-3	Retaining Nut	1
* 2	2938-4	O-Ring	1
3	10671-42	Bottom Forging	1
* 4	10671-17	Valve (Incl. Items 2,4a,4b,4c)	1
4a	10598-2	Snap Ring	1
4b	10747-8	Washer	1
4c	1809-3	Spring	1
* 5	10671-4	Diaphragm	1
6	2881-9	Top Forging	1
7	1518-5	Differential Spring	1
8	1145-19	Mounting Bracket	1
* 9	2155-225	Filter Screen	2
A	1-3268	1/4-20 x 5/8 Fill. Hd. Screw	3
B	1-3310	1/4-20 x 3/4" Fill. Hd. Screw	3
C	1-7303	1/4 Lockwasher	6

* Recommended On-Hand Spare Parts. Always Specify Range, Serial No., or Other Nameplate Information When Ordering Spare Parts.

IMPORTANT

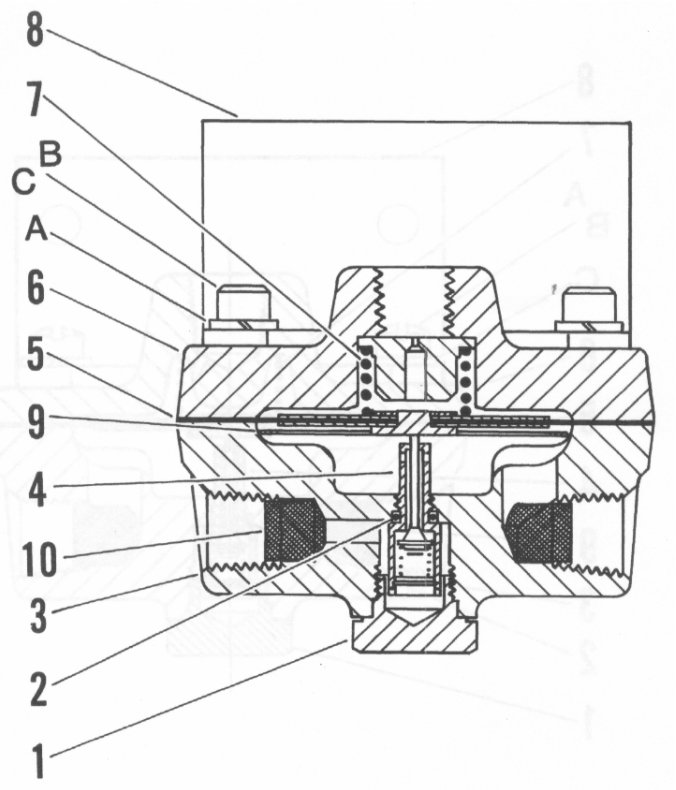
Service Parts Kits are available for servicing the instrument. Contact Siemens for available kits; refer to the Product Support section of this instruction. Some parts in this Parts List may not be available for separate purchase.

PARTS LIST

Siemens Flow Controller, Model 63SD-L

Drawing 12047PL

Rev 5/87



B/M – 12047S12

Item No.	Part No.	Description	Req'd.
* 1	10747-3	Retaining Nut	1
* 2	2938-119	O-Ring	1
3	12047-3	Bottom Forging	1
* 4	10747-4	Valve (Incl. Items 2,4a,4b,4c)	1
4a	10747-9	Snap Ring	1
4b	10747-8	Washer	1
4c	10747-7	Spring	1
* 5	12047-14	Diaphragm	1
6	12041-17	Top Housing	1
7	3131-22	Differential Spring	1
8	1145-19	Mounting Bracket	1
9	12041-23	Protecting Ring	1
*10	2155-225	Filter Screen	2
A	1-7303	1/4" Lockwasher	6
B	1-3480	1/4-20 x 1-1/4" Soc. Hd. Screw	3
C	1-3430	1/4-20 x 1" Soc. Hd. Screw	3

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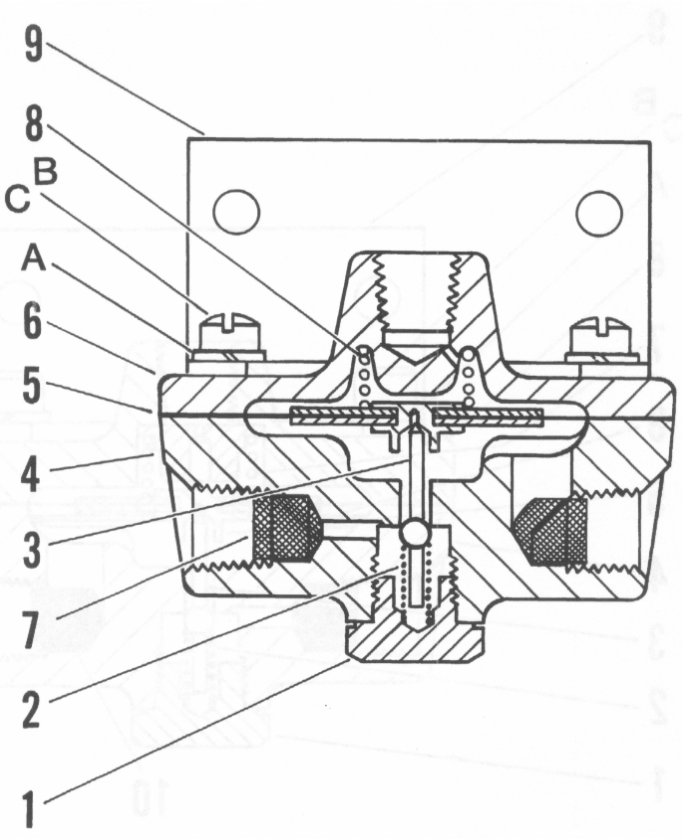
PARTS LIST

Siemens Flow Controller, Model 63BD

Drawing 2881PL

Rev 5/87



B/M – 2881S15

Item No.	Part No.	Description	Req'd.
* 1	2155-6	Retaining Nut	1
* 2	2881-11	Valve Spring	1
* 3	2155-244	Valve Plunger	1
4	1669-14	Bottom Forging	1
* 5	2881-3	Diaphragm	1
6	2881-9	Top Forging	1
* 7	2155-225	Filter Screen	2
8	1518-5	Differential Spring	1
9	1145-19	Mounting Bracket	1
A	1-7303	1/4" Lockwasher	6
B	1-3310	1/4-20 x 3/4" Lg. Fill. Hd. Screw	3
C	1-3268	1/4-20 x 5/8" Lg. Fill. Hd. Screw	3

* Recommended On-Hand Spare Parts. Always Specify Range, Serial No., or Other Nameplate Information When Ordering Spare Parts.

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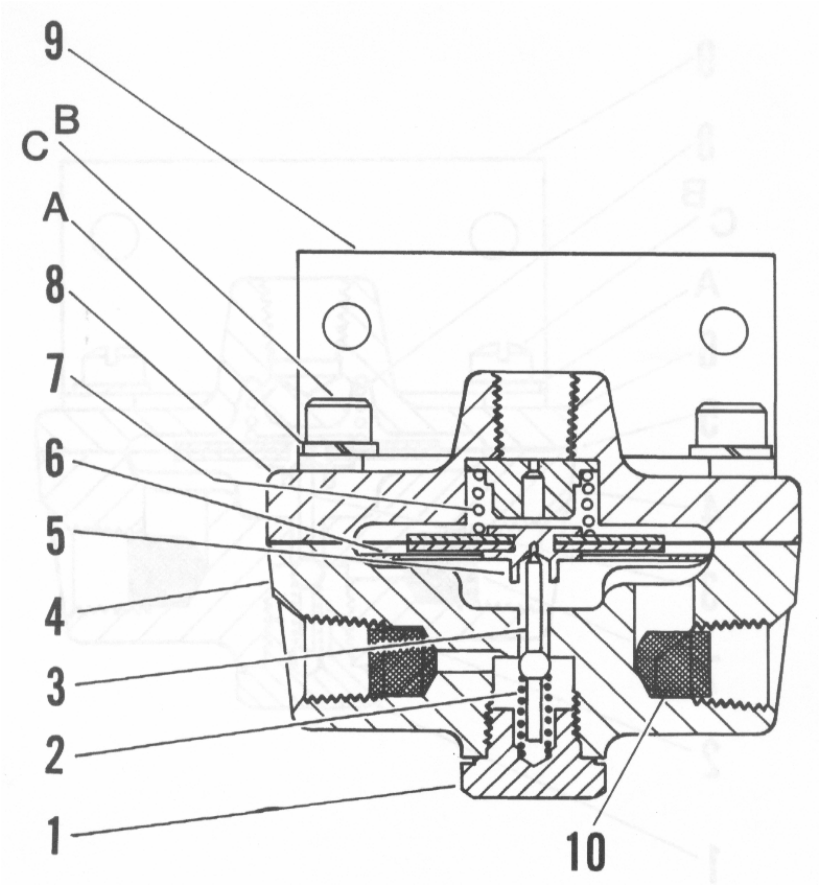
Service Parts Kits are available for servicing the instrument. Contact Siemens for available kits; refer to the Product Support section of this instruction. Some parts in this Parts List may not be available for separate purchase.

PARTS LIST

Siemens Flow Controller, Model 63SD

Drawing 12042PL

Rev 5/87



B/M – 12042S11

Item No.	Part No.	Description	Req'd.
* 1	3131-8	Retaining Nut	1
* 2	2881-11	Valve Spring	1
* 3	3131-23	Valve Plunger	1
4	12042-10	Bottom Forging	1
* 5	12041-34	Diaphragm	1
6	12041-23	Protecting Ring	1
7	3131-22	Spring	1
8	12041-17	Top Housing	1
9	1145-19	Mounting Bracket	1
*10	2155-225	Filter Screen	2
A	1-7303	1/4" Lockwasher	6
B	1-3480	1/4-20 x 1-1/4" Lg. Soc. Hd. Screw	3
C	1-3430	1/4-20 x 1" Lg. Soc. Hd. Screw	3

* Recommended On-Hand Spare Parts. Always Specify Range, Serial No., or Other Nameplate Information When Ordering Spare Parts.

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